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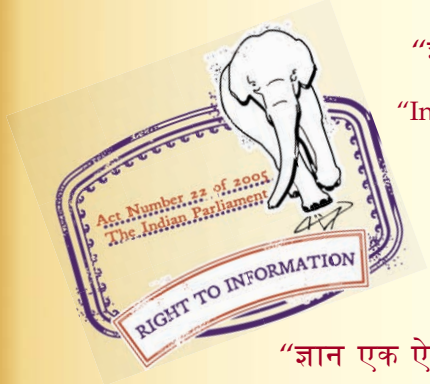

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IS : 8913 - 1978
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Indian Standard

METHOD OF MEASUREMENT OF LAMP CAP TEMPERATURE RISE

UDC 621·3·032·8 : 621·326·7 : 621·317·39 [536·5]

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

January 1979

Indian Standard

METHOD OF MEASUREMENT OF LAMP CAP TEMPERATURE RISE

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(*Continued on page* 11)

Indian Standard

METHOD OF MEASUREMENT OF LAMP CAP TEMPERATURE RISE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 21 August 1978, after the draft finalized by the Electric Lamps and Accessories Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The temperature rise of the lamp cap of a tungsten filament lamp is, in practice, very dependent on the mounting of the lamp and the condition of the cap.

For this reason, it has been necessary to define a method of measurement based on the use of a standard test lampholder. The temperature rise Δt_s measured on the standard test lampholder is then taken as the lamp cap temperature rise for the purpose of this standard.

0.3 Compared with the measurement of the temperature rise of the bare lamp cap, the measurement of the temperature rise of a standard test lampholder has the following advantages:

a) A better approximation to actual operating conditions;

b) Improved reproducibility, as there is less influence from lamp cap material, finish and surface conditions (which also have little influence in actual operating conditions);

c) Levelling of the temperature of various parts of the cap, giving a better over-all picture of the influx of heat from the lamp to the fitting; and

d) Reduced duration of measurements, as the thermocouple is permanently fixed to the test lampholder.

0.4 A method for the butt-welding of the thermocouple is described in the following article:

Stover. Method of butt-welding small thermocouples. *Rev. Sci. Instr.*, 31 (1960). American Institute of Physics, New York. P 605-608.

0.5 Correct procedures for calibration of thermocouple can be found in the following publications:

a) NPL Notes on Applied Science No. 12. Calibration of temperature measuring instruments, Ed 3. 1964, Her Majesty's Stationery Office, London.

b) NBS Circular No. 590. Methods of testing thermocouples and thermocouple materials. 1958. National Bureau of Standards, Washington DC (USA)

0.6 This standard describes the standard method of measurement of lamp cap temperature rise which is to be used when testing lamps for compliance with IS : 418-1978*.

0.7 While preparing this standard assistance has been derived from IEC Publication 360 (1971) Standard method of measurement of lamp cap temperature rise. International Electrotechnical Commission.

0.8 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies the standard method of measurement of lamp cap temperature rise which is to be used when testing lamps for general lighting services for compliance with IS : 418-1978*.

It also describes the test lampholders to be used for lamps fitted with E27, E40 and B22/25×26 caps.

2. DEFINITION

2.0 For the purpose of this standard, the following definition shall apply.

2.1 Temperature Rise of Cap — The surface temperature rise of a standard test lampholder fitted to the lamp cap, when measured under the conditions specified in this standard.

3. GENERAL CONDITIONS FOR MEASUREMENTS

3.1 For these measurements, no previous ageing of the lamp is required. Sufficient stability of the lamp is reached during the time necessary to

*Specification for tungsten filament general service electric lamps (*third revision*).
†Rules for rounding off numerical values (*revised*).

reach thermal equilibrium in the test enclosure. The measurements are made on lamps operating at rated voltage, the supply voltage being maintained constant within $\pm$ 0·5 percent.

The requirements regarding temperature rise apply to an ambient temperature of 25°C. The measurements may, however, be made within the ambient temperature range of 25 $\pm$ 5°C. Measurements shall be made at constant ambient temperature a sufficiently constant value can be obtained by using the test enclosure described in **4**.

If the temperature in the test enclosure differs from 25°C, the value Δt_m measured should be converted to a temperature rise equivalent to an ambient of 25°C in accordance with the following formula:

$$\Delta t_{25} = \Delta t_m + \frac{1}{3}(t_{amb} - 25)\sqrt{\frac{\Delta t_m}{100}}$$

where

Δt_{25} = temperature rise corrected to 25°C ambient, and

Δt_m = temperature rise measured at the temperature in the test enclosure.

The above formula is valid for any ambient temperature between 15°C and 40°C.

4. STANDARD TEST ENCLOSURE

4.1 Temperature measurements shall be made in a draught-free test enclosure. For this purpose, a rectangular metal cabinet is used, the top and at least three sides of which are double-walled, the gap between the inner and outer walls being approximately 150 mm. The base of the cabinet is solid. The walls are made of perforated metal sheet (for example, zinc) with a matt surface the maximum diameter of the holes being 2 mm and the area of the apertures being approximately 40 percent of the total wall area.

4.2 The dimensions of the enclosure shall be such that ambient temperature within the test enclosure will in no case exceed 40°C during normal measuring. The internal size of the enclosure should preferably be not less than 900 mm $\times$ 900 mm $\times$ 900 mm. The dimensions of the enclosure are such that there is a clearance of at least 200 mm between any part of the lamp and the inside of the enclosure.

NOTE — For routine measurements, a smaller enclosure of 500 mm $\times$ 500 mm $\times$ 500 mm may be used, providing the internal ambient temperature does not exceed 40°C during measuring, the lamp being mounted in the centre of the enclosure. This usually limits the rating of lamps which may be tested in this smaller enclosure to 300 W.

4.3 The internal ambient temperature shall be measured with a thermometer screened from direct radiation, the thermometer being placed level with the lamp about halfway between lamp and wall.

4.4 The suspension of the lamp should not affect the convection round the lamp in any adverse manner.

5. TEST LAMPHOLDERS

5.1 Test lampholders consisting of a sleeve, fitted with a thermocouple, have been standardized for lamps provided with the following caps:

a) E27 cap (unskirted) (Fig. 1),

b) E40 cap (unskirted) (Fig. 2), and

c) B22/25 × 26 cap (Fig. 3).

5.2 A flexible stranded copper wire of 0·66 mm² effective cross section is attached to the top of the lampholder (*see* Fig. 1 to 3).

NOTE — The test lampholder for bayonet caps (Fig. 3) is provided with a flexible stranded copper wire, although this is not necessary for the electrical connection of the lamp.

The purpose of this wire is to ensure identical thermal conditions to those of the lampholders for screw caps.

6. THERMOCOUPLE

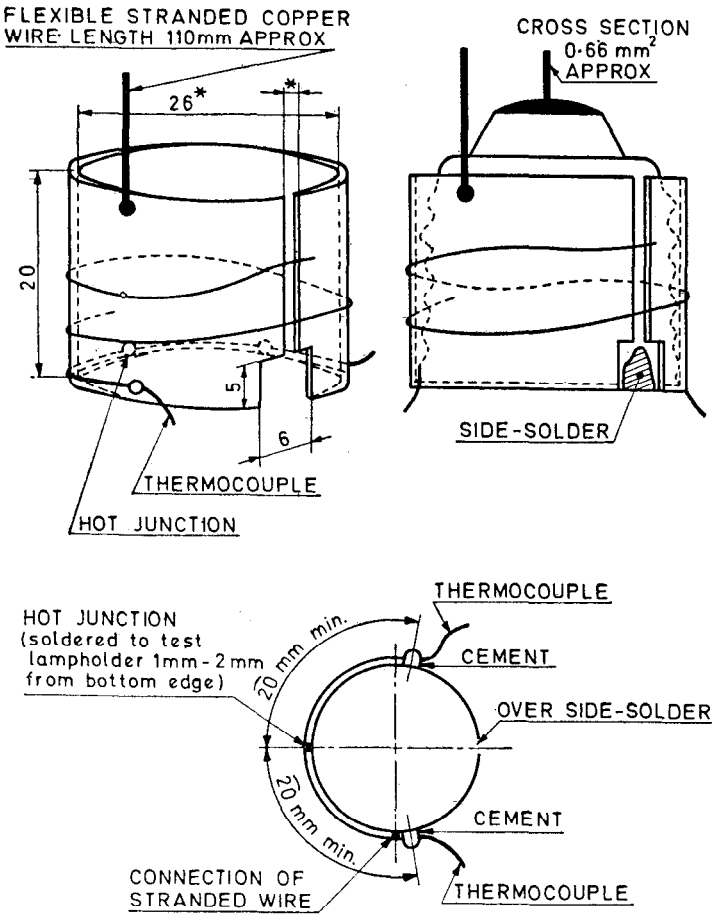
6.1 Material

6.1.1 The materials recommended for the thermocouple are Ni/NiCr or Fe/Constantan. The size of the wires shall be sufficiently thin as not to influence the temperature of the test lampholder. The maximum thickness of the wire shall be 200 μm. The wires shall be provided with an insulating outer layer (enamel, asbestos sheathing, etc). The following method is preferred for making the junction of the two thermocouple wires.

6.1.2 After the ends of the wires have been stripped of their insulation, the two wires shall be set on end at an angle of approximately 150° and spot-welded. Any projecting leads are cut off close to the weld and by pulling the wires taut by hand they will form in line at the junction. Spot-welding will automatically flatten the junction (*see* **0.4**).

6.2 Construction

6.2.1 The thermocouple junction shall be attached to the test lampholder by means of a minimum of solder so that it is in direct mechanical contact with the lampholder, diametrically opposite the lampholder slot and 1 mm to 2 mm from the bottom edge (*see* Fig. 1 to 3). The use of a cement is deprecated. The wires should be insulated right up to the junction.

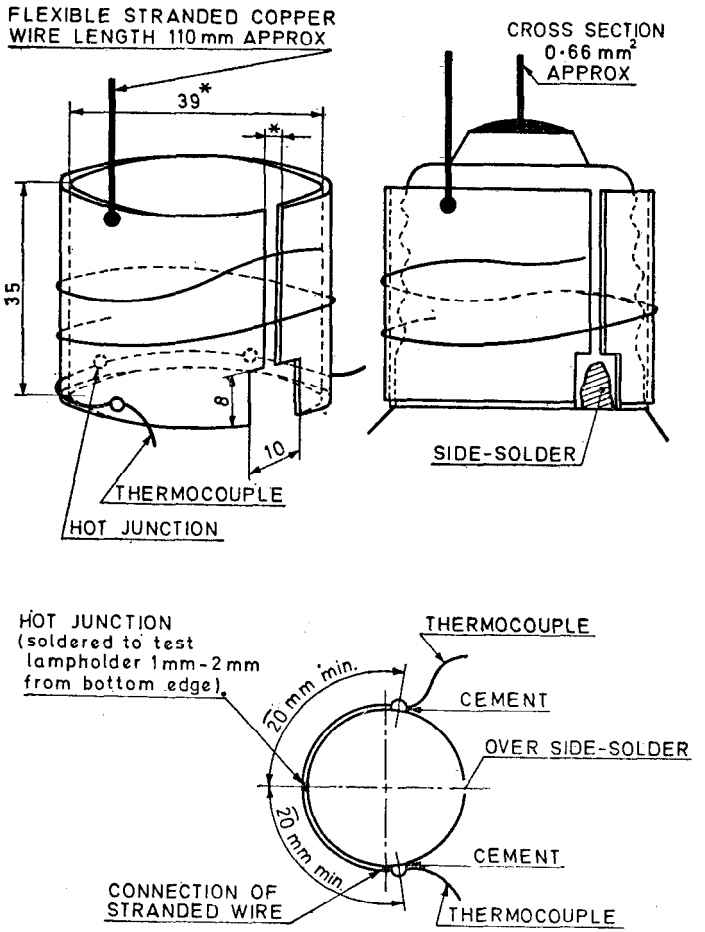


*Inner diameter (approximately). Should allow the holder to be clamped on the cap by spring action. The width of the slit shall be $2 \pm 1{\cdot}5$ mm when the test lampholder is mounted on the lamp.

Material :	Rolled nickel strip : 0·5 mm
Composition :	Nickel : $\geqslant$ 99·5 percent
	Cobalt : $\leqslant$ 0·5 percent
Hardness :	Approximately 135 Vickers
Surface :	Pickled bright and rolled smooth (if necessary, clean with cloth dipped in methylated alcohol)
Spring :	Spring steel wire, approximately 0·8 mm diameter, one and a half turns

All dimensions in millimetres.

FIG. 1 POSITION OF TEST LAMPHOLDER (FOR UNSKIRTED E 27 CAPS) AND THERMOCOUPLE (SPRING NOT SHOWN)

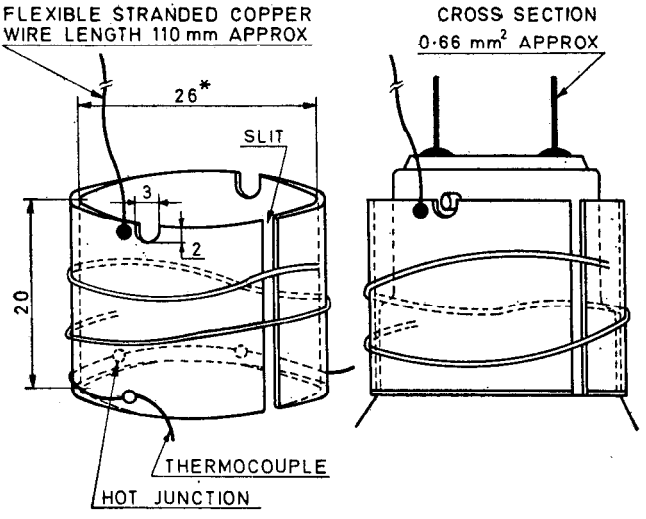


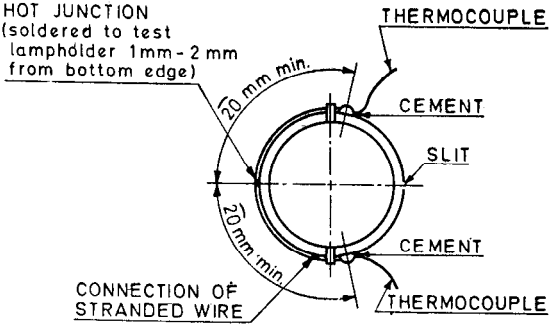
*Inner diameter (approximately). Should allow the holder to be clamped on the cap by spring action. The width of the slit shall be $2 \pm 1{\cdot}5$ mm when the test lampholder is mounted on the lamp.

Material :	Rolled nickel strip : 0·5 mm
Composition :	Nickel : $\geqslant$ 99·5 percent
	Cobalt : $\leqslant$ 0·5 percent
Hardness :	Approximately 135 Vickers
Surface :	Pickled bright and rolled smooth (if necessary, clean with cloth dipped in methylated alcohol)
Spring :	Spring steel wire, approximately 0·8 mm diameter, one and a half turns

All dimensions in millimetres.

FIG. 2 POSITION OF TEST LAMPHOLDER (FOR UNSKIRTED E 40 CAPS) AND THERMOCOUPLE (SPRING NOT SHOWN)





*Inner diameter (approximately). Should allow the holder to be clamped on the cap by spring action. The width of the slit shall be $2 \pm 1{\cdot}5$ mm when the test lampholder is mounted on the lamp.

Material :	Rolled nickel strip : 0·5 mm
Composition :	Nickel : $\geqslant$ 99·5 percent Cobalt : $\leqslant$ 0·5 percent
Hardness :	Approximately 135 Vickers
Surface :	Pickled bright and rolled smooth (if necessary, clean with cloth dipped in methylated alcohol)
Spring :	Spring steel wire, approximately 0·8 mm diameter, one and a half turns

All dimensions in millimetres.

FIG. 3 POSITION OF TEST LAMPHOLDER (FOR B 22/56×26 CAPS) AND THERMOCOUPLE (SPRING NOT SHOWN)

The two leads are then stretched parallel to the edge along the lampholder over at least 20 mm at which point the leads are secured with a little cement.

NOTE — A suitable cement composition comprises 1 part by mass of sodium silicate and two parts by mass of powdered talc.

6.3 Calibration — The thermocouple shall be calibrated at fixed points, namely, the boiling point of water and the solidification point of tin, lead and zinc (*see* **0.5**).

If it is desired to calibrate the thermocouple after it has been mounted on the sleeve, only the boiling point of water should be used (in order to avoid melting the solder).

7. ASSEMBLY OF THE LAMP AND THE TEST LAMPHOLDER IN THE ENCLOSURE

7.1 The test lampholder is pushed up to the cap rim.

7.2 For bayonet caps, two positions of the test lampholder with respect to the cap are possible; measurements shall be made with the thermocouple junction as near as possible to the filament. The lamp shall be hung from two solid copper wires of approximate dimensions: 1 mm diameter and 110 mm long, soldered to the contacts of the cap.

7.3 For screw caps, the position of the test lampholder with respect to the cap is determined by the side solder knot, as indicated in Fig. 1 and 2. The lamp shall be hung from a solid copper wire of approximate dimensions 1 mm diameter and 110 mm long, soldered to the centre contact of the cap.

The stranded copper wire attached to the test lampholder shall be connected to the neutral of the supply.

The lamp is then suspended with its cap up in the centre of the enclosure for measurements. It is very important that the lamp be suspended with its axis as nearly vertical as possible. For suspension and connection to the power supply, it is recommended to use an arrangement adjustable in the vertical direction mounted on the ceiling of the enclosure, so that the lamp can be placed approximately in the centre of the enclosure. When a particular position is specified for a type of lamp, then the lamp shall be tested in the prescribed position.

8. MEASUREMENT OF THE THERMO-ELECTROMOTIVE FORCE

8.1 The temperature reading shall be accurate within $\pm$ 0·5 percent. The thermo-electromotive force shall be measured with the aid of a compensating device. The measurement results for individual lamps shall be rounded off to 1°C.

8.2 When thermal equilibrium has been reached, the test lampholder temperature and the ambient temperature are read; the temperature rise Δt_{25} is calculated using the correction formula if necessary. The minimum burning time before measurement shall be 30 minutes.

(*Continued from page* 2)

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418-1978 Tungsten filament general service electric lamps (*third revision*)

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1258-1967 Bayonet lampholders (*first revision*)

1534 (Part I)-1977 Ballasts for fluorescent lamps: Part I For switch start circuits (*second revision*)

1569-1976 Capacitors for use in tubular fluorescent, high pressure mercury and low pressure sodium vapour discharge lamp circuits (*first revision*)

1606-1966 Automobile lamps (*revised*)

1885 (Part XVI/Sec 3)-1967 Electrotechnical vocabulary: Part XVI Lighting, Section 3 Lamps and auxiliary apparatus

1901-1978 Visual indicator lamps (*first revision*)

2183-1973 Schedule for high pressure mercury vapour lamps (*first revision*)

2215-1968 Starters for fluorescent lamps (*second revision*)

2261-1975 Lamps for flashlights (*first revision*)

2262-1963 Transformers for high voltage luminous discharge tubes

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- (Part I)-1977 Requirements and tests
- (Part II)-1977 Standard lamp data sheets
- (Part III)-1977 Dimensions of G-5 and G-13 bi-pin caps
- (Part IV)-1977 Go and no-go gauges for G-5 and G-13 bi-pin caps

2592-1978 Lamps for lighting on board ships (*first revision*)

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6701-1972 Tungsten filament miscellaneous electric lamps

7013-1973 Schedule for radio dial lamps

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